CLAIMS

What is claimed is:

1. A method for detecting the location of at least one interface in a container made up of a material and having a vertical axis and containing at least one layer of serum, plasma, and cells, the method comprising the steps of:

a) projecting onto the container a first detecting light beam that is substantially transmitted by serum, plasma, and the material but substantially blocked by cells, a portion of the first detecting light beam being transmitted through the container;

b) projecting onto the container a second detecting light beam that is substantially blocked by serum, plasma, and cells, but is substantially transmitted by the material, a portion of the second detecting light beam being transmitted through the container;

c) detecting, as a function of position along the vertical axis of the container, the portion of the first detecting light beam that is transmitted through the container and no significant portion of the second detecting light beam;

d) detecting, as a function of position along the vertical axis of the container, the portion of the second detecting light beam that is transmitted through the container and no significant portion of the first detecting light beam; and

e) determining the location of at least one interface from the detected portions.

2. The method of claim 1 wherein the material is plastic.

3. The method of claim 1 wherein the material is glass.

4. The method of claim 1 wherein the container is a test tube.

5. The method of claim 1 wherein the container contains an upper layer of plasma or serum, and a lower layer of cells.

6. The method of claim 1 or 5 wherein a plurality of labels are on the container.

7. The method of claim 1 wherein the first and second detecting light beams are projected by a projector and detected by a detector and wherein the projector and detector are substantially aligned so that the light beams strike the container substantially perpendicular to the axis of the container.

8. The method of claim 5 wherein the container further contains a middle layer of gel between the layer of serum or plasma and the layer of cells, and both light beams are substantially transmitted by the gel.

9. The method of claim 1 wherein a cap is covering the container.

10. The method of claim 1 wherein the light beams are projected by a laser.

11. The method of claim 1 wherein the light beams are projected by fiber optic cables.

12. A method for detecting the location of at least one interface in a container made up of a material and having a vertical axis and containing an upper layer of at least one of serum and plasma and a lower layer of cells, the method comprising the steps of:

a) projecting onto the container a first detecting light beam of visible light that is substantially transmitted by serum, plasma, and the material, but substantially blocked by the cells, a portion of the first detecting light beam being transmitted through the container;

b) projecting onto the container a second detecting light beam of infrared light that is substantially blocked by serum, plasma, and cells, but is substantially transmitted by the material, a portion of the second detecting light beam being transmitted through the container;

c) detecting, as a function of position along the vertical axis of the container, the portion of the first detecting light beam that is transmitted through the container and no significant portion of the second detecting light beam;

d) detecting, as a function of position along the vertical axis of the container, the portion of the second detecting light beam that is transmitted through the container and no significant portion of the first detecting light beam; and

e) determining the location of at least one interface from the detected portions.

13. The method of claim 12 wherein the container contains a layer of gel between the two layers, and wherein the gel is substantially transparent to the first and second detecting light beams.

14. The method of claim 12 wherein the wavelength of the first light beam is from about 300 nm to about 1200 nm.

15. The method of claim 12 or 14 wherein the wavelength of the second light beam is from about 1.4 μm to about 2.8 μm.

16. The method of claim 12 or 14 wherein the wavelength of the second light beam is from about 3.8 μm to about 6.8 μm.

17. The method of claim 13 wherein the container has at least one label on its exterior that obscures at least one interface.

18. A system for detecting the location of at least one interface in a container made up of a material and having a vertical axis and containing an upper layer of at least one of serum and plasma and a lower layer of cells, the system comprising:

a) a first light source for projecting onto the container a first detecting light beam of visible light that is substantially transmitted by serum, plasma, and the material but substantially blocked by the cells;

b) a second light source for projecting onto the container a second detecting light beam of infrared light that is substantially blocked by serum, plasma, and cells but is substantially transmitted by the material;

c) a first detector for detecting as a function of position along the vertical axis of the container, any portion of the first detecting light beam that is transmitted through the container and no significant portion of the second detecting light beam;

d) a second detector for detecting as a function of position along the vertical axis of the container, any portion of the second detecting light beam that is transmitted through the container and no significant portion of the first detecting light beam; and

e) a processor for determining the location of at least one interface from the detected portions.

19. The system of claim 18 wherein the wavelength of the first light beam is from about 300 nm to about 1200 nm.

20. The system of claim 18 or 19 wherein the wavelength of the second light beam is from about 1.4 μm to about 2.8 μm.

21. The system of claim 18 or 19 wherein the wavelength of the second light beam is from about 3.8 μm to about 6.8 μm.

22. An apparatus for detecting the location of at least one interface in a container made up of a material and having a vertical axis and containing at least one layer of serum, plasma, and cells, comprising:

a) a first projector that projects onto the container a first detecting light beam that is substantially transmitted by serum, plasma, and the material but substantially blocked by cells, a portion of the first detecting light beam being transmitted through the container;

b) a second projector that projects onto the container a second detecting light beam that is substantially blocked by serum, plasma, and cells but is substantially transmitted by the material, a portion of the second detecting light beam being transmitted through the container;

c) a first detector that detects, as a function of position along the vertical axis of the container, the portion of the first detecting light beam that is transmitted through the container;

d) a second detector that detects, as a function of position along the vertical axis of the container, the portion of the second detecting light beam that is transmitted through the container; and

e) a processor that is operably attached to the detectors and determines the location of the interfaces from the detected portions.

23. A method for detecting the location of the interfaces in a container made up of a material and having a vertical axis and containing an upper layer of serum or plasma, a middle layer of gel, and a lower layer of cells, the method comprising the steps of:

a) projecting onto the container a detecting light beam that is substantially blocked by serum and the cells but substantially transmitted by the material and the gel, a portion of the detecting light beam being transmitted through the container;

b) detecting, as a function of position along the vertical axis of the container, the portion of the detecting light beam that is transmitted through the container; and

c) determining the location of the interfaces from the detected portions.

24. The method of claim 1 wherein the location of the interface that is determined is the location between air and the contents of the container.

25. The method of claim 1 wherein the container contains no layer of cells.

26. An apparatus for detecting at least one interface in a container made up of a material and having a vertical axis and containing an upper layer of serum or plasma, a middle layer of gel, and a lower layer of cells, comprising:

a) a projector that projects onto the container a detecting light beam that is substantially blocked by serum, plasma, and cells but substantially transmitted by the material and the gel, a portion of the detecting light beam being transmitted through the container;

b) a detector that detects, as a function of position along the vertical axis of the container, the portion of the detecting light beam that is transmitted through the container; and

c) a processor that is operably attached to the detector and determines the interfaces from the detected portions.